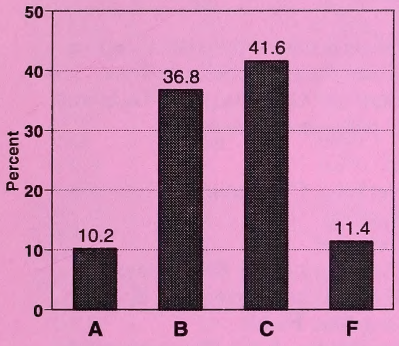
AL.1.1490
C.2
CANADIANA
JUL 21 1998

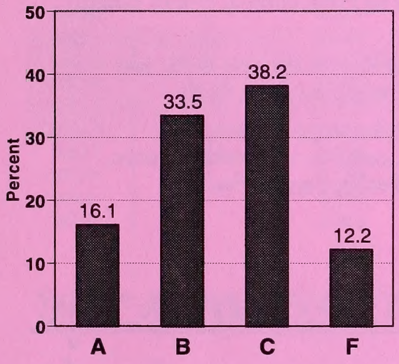
Science 30

Diploma Examination Results
Examiners' Report for January 1998

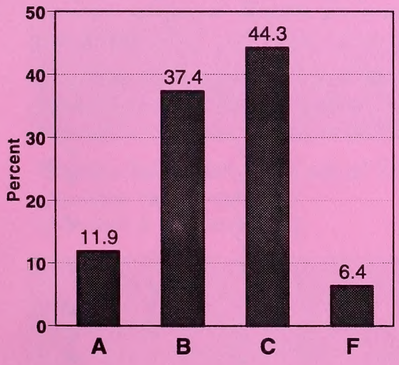
School-Awarded Mark



Diploma Examination Mark



Final Course Mark



The summary information in this report provides teachers, school administrators, and students with an overview of results from the January 1998 administration of the Science 30 Diploma Examination. This information is most helpful when used with the detailed school and jurisdiction reports that have been provided electronically to schools and school jurisdiction offices. A provincial report containing a detailed analysis of the combined January, June, and August results is made available annually.

Description of the Examination

The Science 30 Diploma Examination consists of 44 multiple-choice questions worth 55%, 12 numerical-response questions worth 15%, and two written-response questions worth 30% of the total examination mark.

Achievement of Standards

The information reported is based on the final course marks achieved by 361 students in Alberta who wrote the January 1998 examination.

- 93.6% of the 361 students achieved the acceptable standard (a final course mark of 50% or higher).
- 11.9% of students achieved the standard of excellence (a final course mark of 80% or higher).

Students demonstrated a good understanding of the sources of pollution and its effects.

Students continue to experience difficulty balancing nuclear reactions and calculating the energy produced by nuclear reactions. Although they were successful with some multistep problems, the manipulation of more complex formulas remains a challenge.

Science 30 students continued to improve their communication skills. Their answers were generally well organized, and all parts of the written-response questions were addressed. Responses could have been improved by greater use of specific examples to support ideas.

Approximately 45.7% of students who wrote the examination were female. Of these, about 86.7% achieved the acceptable standard on the examination, compared with 88.8% of the male students. Approximately 17.0% of the female students achieved the standard of excellence, compared with 15.3% of the male students. The average examination mark achieved by the female students was 65.0%, and the male students achieved an average mark of 65.7%.

Students First!
Student Evaluation

Alberta
EDUCATION

Provincial Averages

- The average school-awarded mark was 63.6%.
- The average diploma examination mark was 65.4%.
- The average final course mark, representing an equal weighting of the school-awarded mark and the diploma examination mark, was 65.1%.

Results and Examiners' Comments

This examination has a balance of question types and difficulties. It is designed so that students achieving the acceptable standard will obtain a mark of 50% or higher, and students achieving the standard of excellence will obtain a mark of 80% or higher.

In the following table, diploma examination questions are classified by question type: multiple choice (MC), numerical response (NR), and written response (WR). The column labelled "Key" indicates the correct response for multiple-choice and numerical-response questions. For numerical-response questions, a limited range of answers was accepted as being equivalent to the correct answer. For multiple-choice and numerical-response questions, the "Difficulty" indicates the proportion (out of 1) of students answering the question correctly. For written-response questions, the "Difficulty" is the mean score achieved by students who wrote the examination.

Questions are also classified by general learner expectations. Even though some questions address more than one GLE, only one GLE was selected for the purpose of this report.

Knowledge:

GLE 1	Nervous, Circulatory, & Immune Systems
GLE 2	Genetics
GLE 3	Chemistry & the Environment
GLE 4	Gravitational, Electrical, & Magnetic Fields
GLE 5	Astronomy & the Electromagnetic Spectrum
GLE 6	The Production & Use of Energy

Skills:

SPC	Scientific Process Skills and Communication Skills

Science, Technology, Society:

STS	Connections Among Science, Technology, & Society

Blueprint

Question	Key	Difficulty	GLE 1	GLE 2	GLE 3	GLE 4	GLE 5	GLE 6	SPC	STS
MC1	D	0.504			✓					✓
NR1	4312	0.573			✓				✓	✓
MC2	A	0.512			✓					✓
MC3	A	0.881					✓		✓	✓
MC4	C	0.587	✓							
MC5	C	0.681	✓							
MC6	B	0.554	✓							
MC7	A	0.823			✓				✓	✓
MC8	A	0.878	✓							✓
MC9	B	0.427	✓							
NR2	2314	0.770						✓		✓
MC10	C	0.795						✓		✓
MC11	A	0.906						✓	✓	
MC12	C	0.886						✓		✓
MC13	C	0.596						✓		
MC14	C	0.601						✓		✓
NR3	1.7	0.410				✓			✓	
NR4	43	0.861				✓			✓	✓
MC15	B	0.884						✓		✓
MC16	C	0.753						✓		✓
MC17	D	0.936						✓		✓
MC18	B	0.673						✓		✓
MC19	C	0.789						✓		✓
NR5	8.52	0.532				✓			✓	

Question	Key	Difficulty	GLE 1	GLE 2	GLE 3	GLE 4	GLE 5	GLE 6	SPC	STS
MC20	A	0.781				✓				
MC21	B	0.812				✓			✓	
NR6	10.8	0.490				✓			✓	
MC22	B	0.665				✓				
MC23	B	0.776				✓				✓
MC24	B	0.828					✓		✓	
MC25	D	0.942					✓			✓
MC26	D	0.759			✓				✓	✓
NR7	2341	0.751			✓				✓	✓
MC27	D	0.593					✓			✓
MC28	A	0.579			✓				✓	✓
MC29	C	0.731			✓				✓	
NR8	25A	0.643		✓					✓	
MC30	A	0.870		✓					✓	
MC31	A	0.302					✓		✓	
MC32	B	0615			✓					
MC33	C	0.712	✓							
MC34	D	0.906		✓					✓	
MC35	C	0.753		✓					✓	
MC36	C	0.820					✓			
MC37	D	0.726	✓							✓
MC38	B	0.787	✓							
MC39	C	0.537	✓							
MC40	D	0.584	✓							
MC41	A	0.573	✓						✓	✓
NR9	2143	0.557	✓							
MC42	B	0.213			✓					✓
NR10	2314	0.693					✓			
NR11	1320	0.435					✓		✓	
MC43	A	0.535				✓				
NR12	2.54	0.828				✓			✓	
MC44	D	0.596					✓			✓
WR1		0.584							✓	✓
WR2		0.563							✓	✓

Subtests: Machine Scored and Written Response (Average by Subtest)

When analyzing detailed results, please bear in mind that subtest results **cannot** be directly compared. Results are in average raw scores.

Machine scored: 38.21 out of 56
Multiple choice: 30.66 out of 44
Numerical response: 7.54 out of 12

Written Response: 13.98 out of 24
Question 1: 7.01 out of 12
Question 2: 6.75 out of 12

Raw Score Averages by General Learner Expectation

General Learner Expectations:

GLE 1	Nervous, Circulatory, & Immune Systems	7.6	out of	12
GLE 2	Genetics	3.2	out of	4
GLE 3	Chemistry & the Environment	6.1	out of	10
GLE 4	Gravitational, Electrical & Magnetic Fields	6.7	out of	10
GLE 5	Astronomy & the Electromagnetic Spectrum	6.1	out of	9
GLE 6	The Production & Use of Energy	8.6	out of	11
Skills	Scientific Process Skills and Communication Skills	22.3	out of	34
STS	Connections Among Science, Technology, and Society	25.4	out of	38

Multiple-Choice and Numerical-Response Questions

The following table gives results for 8 questions selected from the examination. The table shows the percentage of students in four groups that answered the question correctly. The comments following the table discuss some of the understandings and skills the students may have used to answer these questions.

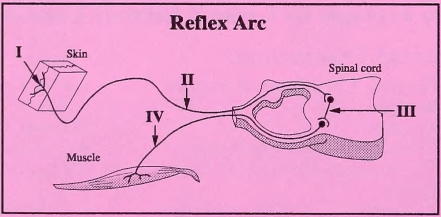
Percentage of Students Correctly Answering Selected Machine-Scored Questions

	Question Number							
Student Group	**MC4**	**MC5**	**MC6**	**MC9**	**MC39**	**MC34**	**MC21**	**MC28**
All Students	58.7	68.1	55.4	42.7	53.7	90.6	81.2	57.9
Students achieving the *standard of excellence* (80% or higher, or A) on the whole examination	84.5	87.9	82.8	62.1	74.1	96.6	91.4	87.9
Students achieving the *acceptable standard* (between 50% and 79%, B or C) on the whole examination	58.4	66.8	53.3	41.8	54.3	93.3	80.2	57.4
Students who have not achieved the *acceptable standard* (49% or less, or F), on the whole examination	29.5	50.0	34.1	25.0	27.3	68.2	72.7	25.0

4. Members of a soccer team ate lunch at the cafeteria after a game. Which body system is in control of decreasing the heart rate and increasing the activity of the digestive system after physical activity?

A. Sympathetic nervous system
B. Sensory motor nervous system
***C.** Parasympathetic nervous system
D. Sensory somatic nervous system

Use the following information to answer the next question.



Reflex Arc

5. When an employee's hand came very close to a hot burner, he immediately pulled it away through reflex action. The part of the reflex arc that coordinates the sensory input with the motor response is labelled

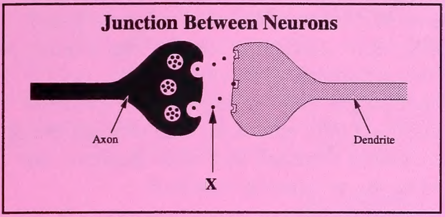
A. I
B. II
***C.** III
D. IV

Multiple-choice questions 4, 5, 6, 9 and 39 provide an indication of students' knowledge and understanding of how the human body maintains homeostasis. Although the students demonstrated a strong understanding of the other biological topics on this examination, they were weaker in this area.

On **question 4**, 58.7% of the students responded correctly. By choosing A or C, 80.1% of the students demonstrated that they understood that it was either the sympathetic or the parasympathetic system. As demonstrated in the table above, the weaker students had a great deal of difficulty with this question.

For **question 5**, students were required to recognize the part of the reflex arc that coordinates input with responses. Of the students writing, 68.1% answered the question correctly.

Use the following information to answer the next question.



6. In order for an impulse to travel through a reflex arc, it must pass from one neuron to another. The substance labelled **X most likely** represents

A. sodium ions
***B.** acetylcholine
C. cholinesterase
D. potassium ions

In **question 6**, students demonstrated that many have a limited understanding of the passage of a nerve impulse across a synapse, with only 55.1% of the students responding correctly.

---

9. When customers enter a dimly lit cafeteria from the bright sunlight, their eyes have to adjust to the difference in light intensity. The adjustment of their eyes involves an increased reliance on the

A. rods and a decrease in the size of the pupil
***B.** rods and an increase in the size of the pupil
C. cones and a decrease in the size of the pupil
D. cones and an increase in the size of the pupil

Question 9 required students to understand the role of rods, cones, and pupil size in the adaptation of the eye to varying light intensity. Of the students writing, only 42.7% answered correctly. By choosing A or B, 58.4% of the students demonstrated that they realized that dim light increases reliance on rods. By choosing B or D, 69.9% of the students demonstrated that they realized the pupil will dilate in dim light.

---

39. A victim from a car accident was bleeding from a leg wound. This blood loss would result in

A. a decrease in blood pressure, which would be compensated for by dilation of the arterioles
B. an increase in blood pressure, which would be compensated for by dilation of the arterioles
***C.** a decrease in blood pressure, which would be compensated for by constriction of the arterioles
D. an increase in blood pressure, which would be compensated for by constriction of the arterioles

Question 39 required the students to understand the effect of blood loss on blood pressure, and then identify the method the body would use to compensate for this change. Of the students writing, 53.7% answered correctly. By choosing A or C, 80.5% of the students indicated that they understood that blood loss would result in a loss of blood pressure.

Use the following information to answer the next question.

An experiment was conducted in which fruit flies were irradiated with a variety of wavelengths to test what effects the irradiation would have on the number of offspring they produced. The following data were obtained.

Fruit Fly Offspring

Type of Irradiation	**Average Number of Offspring per Fly**
Visible light irradiation	404.4
Infrared irradiation	404.4
X-ray irradiation	160.0
Gamma irradiation	57.1

34. In this experiment, the responding variable is the

A. type of irradiation
B. number of mutations
C. amount of irradiation
***D.** number of offspring per fly

Use the following information to answer the next question.

The high voltages in transmission lines must be stepped down for end use by consumers. A transformer steps down the voltage from 4 400 V to 220 V.

21. The ratio of primary turns to secondary turns in this transformer is

A. 1 : 20
***B.** 20 : 1
C. 1 : 5
D. 5 : 1

---

28. One of the scientists monitored acid deposition by using a pH meter. She determined the pH of a sample of lake water to be 5.21. The hydronium ion concentration in this sample would be

***A.** 6.2×10^{-6} mol/L
B. 2.1×10^{-5} mol/L
C. 7.2×10^{-1} mol/L
D. 1.6×10^{5} mol/L

Question 34 provides an indication of how well students understand experimental procedures. On question 34, 90.6% of the students responded correctly, demonstrating that they can identify the responding variable in an experiment. As indicated on the table on page 4, this question discriminated between those students achieving the acceptable standard and those students not achieving the acceptable standard.

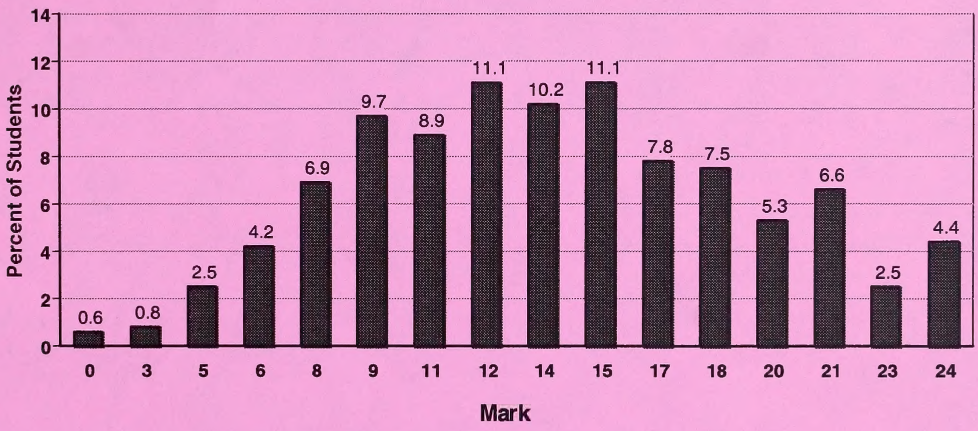
Of the 56 machine-scored questions on the examination, 9 questions required calculations. Multiple-choice questions 21 and 28 provide an indication of how well students perform on this type of question.

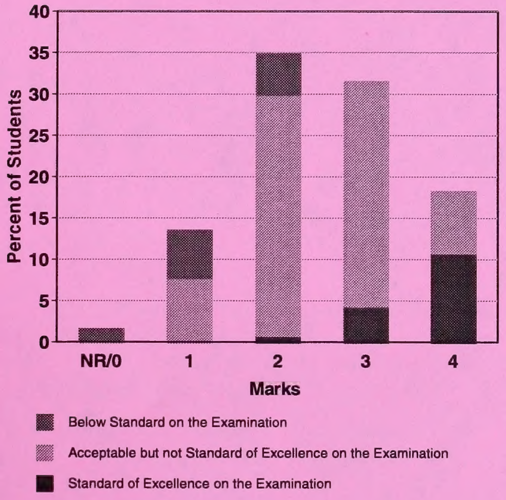
Multiple-choice question 21 can be answered by using the formula from the data book $\frac{N_p}{N_s} = \frac{V_p}{V_s}$. Of all students, 81.2% responded correctly. By choosing A, 15.9% indicated that they realized the number of turns should be different by a factor of 20 but reversed the ratio.

Multiple-choice question 28 was answered correctly by 57.9% of the students. The formula $\text{pH} = -\log_{10}[H_3O^+_{(aq)}]$ is given in the data booklet. The student must be able to enter this into the calculator properly. It is also possible to choose the correct answer by inspection. A pH of 5.21 will have a hydronium concentration expressed in scientific notation with an order of magnitude of 10^{-6}.

Written-Response Questions

Performance on written-response questions has improved steadily since the beginning of field testing in January 1994, when a large portion of students did not even attempt to answer the written-response questions. Many students are now using specific examples from science and technology in their responses. Of the students who wrote this examination, one student received no mark for both written-response questions, 66.5% received 12 marks or more out of 24, and 18.8% received 20 marks or more out of 24. The average mark on the written-response questions was 58.2%


Distribution of Marks for Written Response


Distribution of Marks for Question 1

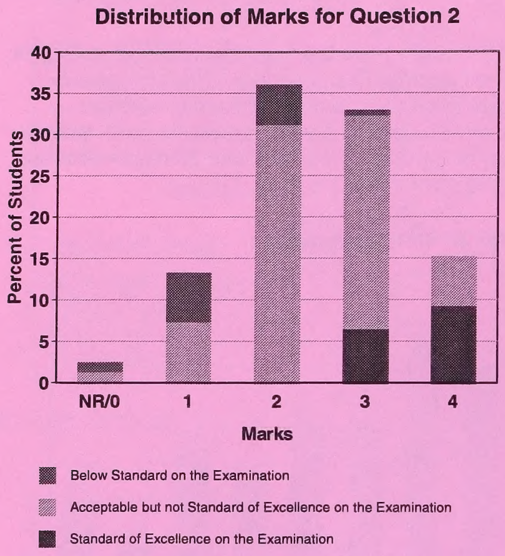
Question 1 This question required the students to describe environmental problems that might occur in a lake because of surrounding industrial activities. This question was attempted by all but three of the students who wrote the examination.

Most of the students were able to list a few of the problems associated with the coal-fired generating plant. Fewer were able to describe the effects of the farming area.

Most of the students were able to list some actions that could be taken to improve the water quality of the lake. The students achieving the standard of excellence provided a detailed list of problems associated with the nearby industries and were able to describe a number of methods to remedy the problems listed. Their answers were detailed and well organized.

On this question, the average was 58.4%. On this question, 71.5% of the student population achieved the acceptable standard and 11.3% achieved the standard of excellence.

National Library of Canada
Bibliothèque nationale du Canada
3 3286 51570 8788



Question 2 All but six of the students who wrote the examination attempted this question.

Almost all of the students who attempted this question were able to list some benefits and risks for the technology they selected. Most students included some specific examples to accompany their list of risks and benefits.

Students who achieved the standard of excellence provided a detailed explanation of the risks and benefits of the technology. Their opinion of how the technology should be used in the future was realistic, and they used specific examples to support their opinions.

On this question, the average was 56.3%. On this question, 69.0% of the student population achieved the acceptable standard and 15.2% achieved the standard of excellence.

For further information, contact John Drader (jdrader@edc.gov.ab.ca) or Corinne McCabe (cmccabe@edc.gov.ab.ca) at the Student Evaluation Branch at 427-0010.
To call toll-free from outside of Edmonton, dial 310-0000.

Copyright 1998, the Crown in Right of Alberta, as represented by the Minister of Education, Student Evaluation Branch, 11160 Jasper Avenue, Edmonton, Alberta T5K 0L2. All rights reserved.

***Alberta educators** may reproduce this document for non-profit **educational purposes**.*